

THE BRITISH COMPUTER SOCIETY
THE BCS PROFESSIONAL EXAMINATION
Certificate

TECHNOLOGY

18th April 2005, 2.30 p.m.-4.30 p.m.
Time: TWO hours

SECTION A

Answer TWO questions out of FOUR. All question carry equal marks.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. a) The *stored program* von Neumann digital computer executes instructions in a *two-phase fetch/execute* mode.

Explain what we mean by the following terms used in the above statement:

- i) stored program
- ii) fetch/execute mode (also called fetch/execute cycle) **(6 marks)**

- b) The processor (CPU) is constructed from *registers*, *buses* and *functional units* such as the ALU (arithmetic and logical unit).

Explain what we mean by '*registers*, *buses*, and *functional units*' and show how each of these contributes to the performance of a digital computer. Use diagrams to illustrate your answer where necessary. **(9 marks)**

- c) A computer's instruction (at the machine language level or the assembly language level) may have a one-address, two-address or three address instruction format. Explain what we mean by '*one-address*, *two-address* and *three address*' instruction formats. Provide simple examples of these instructions. **(5 marks)**

- d) Each type of computer (e.g., Pentium, 68K, ARM, PowerPC) has a unique instruction set. Although there are considerable variations between computers, most computers have broadly similar instructions (in terms of the operations they carry out).

Describe the basic features and characteristics of a computer's instruction set (i.e., instruction types, register structure, addressing modes).

You may choose a real computer or you may use a hypothetical computer to illustrate your answer. The question is intended to test your knowledge of basic instruction types (i.e., classes) and addressing modes. **(10 marks)**

2. A major contribution to the success of the personal computer has been the use of the graphical operating system, of which Windows™, is an example.

- a) Explain the facilities provided by such an operating system to a typical modern PC. You should include facilities that are *visible* to the user and facilities that are *invisible* (i.e., *transparent*) to the user (e.g., memory management).

Your answer should include reference to the way in which operating systems have expanded to include functions that were once not associated with operating systems (e.g., facilities that cover communications and networking).

- b) What are the major limitations of current operating systems (i.e., what limitations or weaknesses do they have and how can they be improved)?

Your answer should conclude with a discussion of the way in which you expect operating systems for personal computers to develop over the next few years. **(30 marks)**

3. a) All computers have to provide input/output mechanisms to enable information from the external world to be read into the computer and information from the computer to be sent to the external world.

Describe the ways in which a computer may implement an I/O strategy for transferring information between itself and external peripherals. For the purpose of this question you may consider the disk drive and display system to be external peripherals. **(20 marks)**

- b) A computer processes digital images. These images are 10 cm x 16 cm and are printed at a resolution of 30 pixels/cm. Each pixel consists of a dot in one of the three primary colors plus a 'grey' dot. Each of these four dots that make up a pixel has one of 256 levels of intensity.

An image is transmitted over a data link in the form of frames, where each frame consists of 256 bits of user (i.e., image data) and 64 bits of control and routing data. The data link transmits information at a rate of 64Kbits/s./

- i) How large is each image in bytes?
ii) How long does it take to transmit an image? **(10 marks)**

4. The success of the personal computer revolution owes as much to the development of versatile, powerful, low-cost peripherals such as DVDs, USB and FireWire interfaces, BlueTooth and WiFi, and Flash memory as much as to developments in computer architecture and semiconductor technology.

Explain how the above features have contributed to the continuing success of the personal computer.

You should provide details of the characteristics of these new technologies and their applications and features, but you are not required to provide in-depth descriptions of their operating modes. **(30 marks)**

SECTION B

Answer FIVE questions out of EIGHT. All questions carry equal marks.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

5. For each of the following pairs of terms, differentiate between:
a) a *local area network* and a *wide area network* (6 marks)
b) a *router* and a *switch* (6 marks)
6. Differentiate between *hypertext transfer protocol* and *hypertext markup language*. Explain how each of the techniques is used. (12 marks)
7. The internet has made users vulnerable to various malicious threats.
a) Describe the threats faced *by* internet users. (6 marks)
b) Suggest possible actions users should take to deal with such threats. (6 marks)
8. Carry out the following operations
a) Convert $2D6_{16}$ to binary (3 marks)
b) 11100111_2 OR 11111111_2 (3 marks)
c) $10011001_2 + 11110101_2$ (3 marks)
d) 10101011_2 AND 11111001_2 (3 marks)
9. As computers become more sophisticated, users find it more difficult to understand the meaning of some of the 'computer jargon' found in newspapers and journals.

Using non-technical terms, produce a simple description of a modern personal computer. Your answer should cover the computer's hardware, software and networking components. (12 marks)
10. Peripheral devices are very important to the CPU of a computer.
a) Explain the relevance of the above statement. (6 marks)
b) Describe the main characteristics of a DVD as a peripheral device. (6 marks)
11. The internet and electronic mail have become major aspects of our daily lives.
a) By means of examples describe and explain the function and importance of a web browser. (4 marks)
b) SPAM can seriously affect internet users. Explain what SPAM is. (4 marks)
c) Describe how users can protect themselves against SPAM. (4 marks)

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- 12.** *a)* Briefly, describe and explain the operation of a full adder. **(6 marks)**
- b)* Using NAND gates only, show the construction of a half adder. **(6 marks)**